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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.
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08/870,836 06/06/97 HAMPAPUR

A VIRAGE. 007A

 EXAMINER

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RAO, A

 ART UNIT PAPER NUMBER

2713

DATE MAILED:

01/18/00

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Please find below and/or attached an Office communication concerning this application or proceeding.

Commissioner of Patents and Trademarks

Interview Summary	Application No. 08/870,386	Applicant(s) Hamapapur et al.
	Examiner Anand Rao	Group Art Unit 2713

All participants (applicant, applicant's representative, PTO personnel):

(1) Anand Rao (3) _____
 (2) Mr. Carson (#34,303) (4) _____

Date of Interview Jan 14, 2000

Type: Telephonic Personal (copy is given to applicant applicant's representative).

Exhibit shown or demonstration conducted: Yes No. If yes, brief description:

Agreement was reached. was not reached.

Claim(s) discussed: 1-23 (with particular attention to claims 1, 8, 18, and newly proposed claimed 23).

Identification of prior art discussed:

US Patent 5,635,982 to Zhang et al.

Description of the general nature of what was agreed to if an agreement was reached, or any other comments:

After discussing the Zhang reference in detail, the proposed limitations of "a structural difference measure based on identified edges... as in claims 1, 8, 18 and proposed claim 23 which discloses the using "non-accumulated differences..." overcomes the art of record, and would place the application in a favorable condition for allowance if submitted as a formal response after final.

(A fuller description, if necessary, and a copy of the amendments, if available, which the examiner agreed would render the claims allowable must be attached. Also, where no copy of the amendments which would render the claims allowable is available, a summary thereof must be attached.)

1. It is not necessary for applicant to provide a separate record of the substance of the interview.

Unless the paragraph above has been checked to indicate to the contrary, A FORMAL WRITTEN RESPONSE TO THE LAST OFFICE ACTION IS NOT WAIVED AND MUST INCLUDE THE SUBSTANCE OF THE INTERVIEW. (See MPEP Section 713.04). If a response to the last Office action has already been filed, APPLICANT IS GIVEN ONE MONTH FROM THIS INTERVIEW DATE TO FILE A STATEMENT OF THE SUBSTANCE OF THE INTERVIEW.

2. Since the Examiner's interview summary above (including any attachments) reflects a complete response to each of the objections, rejections and requirements that may be present in the last Office action, and since the claims are now allowable, this completed form is considered to fulfill the response requirements of the last Office action. Applicant is not relieved from providing a separate record of the interview unless box 1 above is also checked.

*ANDY RAO
PRIMARY EXAMINER*

*ANAND RAO
PATENT EXAMINER
ART UNIT 2713*

Examiner Note: You must sign and stamp this form unless it is an attachment to a signed Office action.

FOR DISCUSSION PURPOSES ONLY - DO NOT ENTER

Attorney Docket No.: VIRAGE.007A

U.S. Application No.: 08/870,836

Filing Date : June 6, 1997

Group Art Unit: 2713

Title: KEY FRAME SELECTION

Examiner: Anand Rao

We wish to discuss Claims 1, 7, 8, 14, 18 and new Claim 23.

Attached are (1) Figures 4 and 4A consolidated on one sheet as filed in Europe for convenient review of Zhang's complete algorithm and (2) hand drawn figures showing the distinction between Zhang and Virage algorithms in accumulating differences – see new Claim 23.

Section 102(e)

Claims 1 - 22 were rejected under 35 U.S.C. § 102(e) as being anticipated by Zhang, et al., U.S. Patent No. 5,635,982.

Amend Claims 1, 8 and 18:

1. (Twice Amended) A computerized method of extracting a key frame from a video, comprising:

- a) providing a reference frame;
- b) providing a current frame different from the reference frame;
- c) determining a chromatic difference measure between the reference frame and the current frame;
- d) determining a structure difference measure between the reference frame and the current frame based, at least in part, on edges identified in each of the frames; and
- e) identifying the current frame as a key frame if the chromatic difference measure exceeds a chromatic threshold and the structure difference measure exceeds a structure threshold.

8. (Twice Amended) A computerized method of extracting a key frame from a video having a plurality of frames, the method comprising:

- a) providing a reference frame;
- b) providing a current frame different from the reference frame;

- c) determining a first difference measure between the reference frame and the current frame;
- d) determining a second difference measure between the reference frame and the current frame based, at least in part, on edges identified in each of the frames; and
- e) identifying the current frame as a key frame if the first difference measure exceeds a first threshold and the second difference measure exceeds a second threshold.

18. (Twice Amended) A computerized method of extracting a key frame from a video having a plurality of frames, the method comprising:

- a) providing a reference frame;
- b) providing a current frame different from the reference frame;
- c) determining a structure difference measure between the reference frame and the current frame based, at least in part, on edges identified in each of the frames; and
- d) identifying the current frame as a key frame if the structure difference measure exceeds a structure threshold.

New Claim

Add new Claim 23:

23. A computerized method of extracting a key frame from a video having a sequence of frames, the method comprising:

- a) providing a reference frame;
- b) providing a current frame different from the reference frame;
- c) determining a chromatic difference measure between the reference frame and the current frame;
- d) determining a structure difference measure between the reference frame and the current frame; and
- e) identifying the current frame as a key frame if the chromatic difference measure exceeds a chromatic threshold and the structure difference measure exceeds a structure threshold, without accumulating differences between pairs of frames of the video sequence.

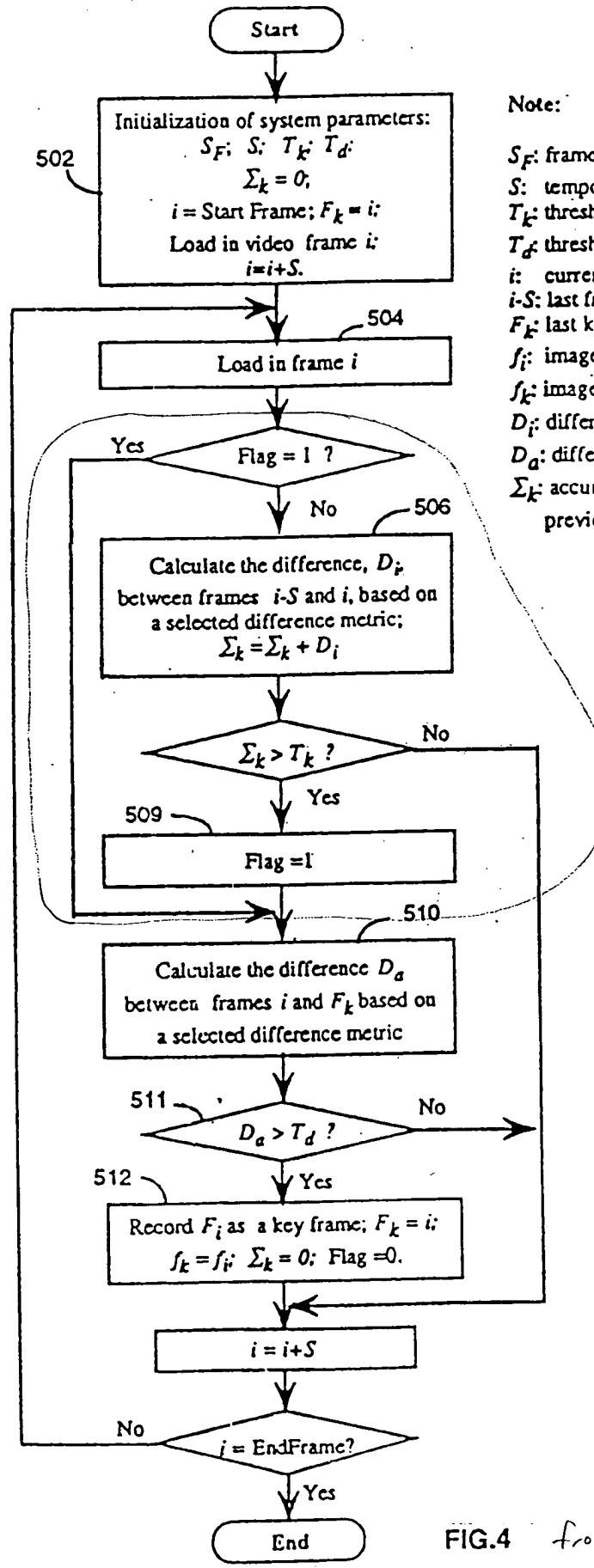
Comments on Zhang:

The differences between Applicant's method of extracting a key frame and the method described by Zhang will be explained at the personal interview.

Figures 4 and 4A depict the keyframe extraction method of Zhang. The state after state 504 (not labeled, but could be state 505) through state 509 are not performed by Applicant. Applicant does not accumulate the differences between consecutive frames (state 506), and the accumulated differences are not compared to a threshold (state between 506 and 509). States 510 and 511 are performed by Zhang for one difference metric and one threshold.

In contrast, Applicant determines both a first difference measure and a second difference measure (which is orthogonal to the first difference measure) individually between the previous keyframe and each successive frame. Each of the results is compared to a corresponding first threshold and second threshold. If both thresholds are exceeded, the current frame is identified as a keyframe. In one embodiment of Applicant's invention, the second difference measure is a structure difference measure that is based, at least in part, on edges identified in each of the frames.

In another embodiment, the result of the first difference measure is compared to the first threshold before the second measure is computed. If the result of the first difference measure exceeds the first threshold, the second difference measure is computed and tested against the second threshold. Note that both thresholds need to be exceeded on the same frame for the frame to be considered a keyframe. This is not required in Zhang, since frames after the point at which the accumulated difference is greater than the threshold (state between 506 and 509) continue to be tested only for passing the test at state 511.



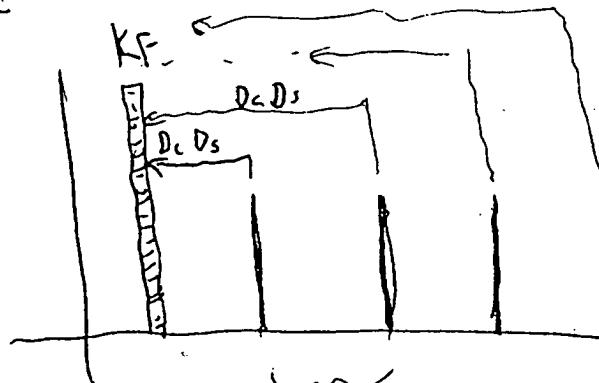
Note:

S_F : frame size;
 S : temporal skip factor;
 T_k : threshold for potential key frame;
 T_d : threshold for key frame;
 i : current frame;
 $i-S$: last frame;
 F_k : last key frame recorded;
 f_i : image feature of frame i ;
 f_k : image feature of previous key frame;
 D_i : difference between frames $i-S$ and i ;
 D_a : difference between frames F_k and i ;
 Σ_k : accumulative differences after
previous key frame;

FIG.4 from Zhang's corresponding PCT application

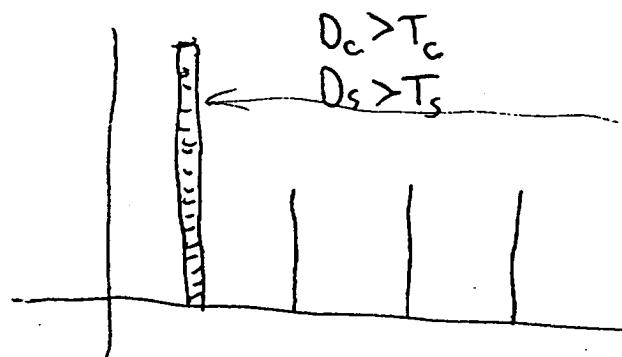
VIRAGE
Applicant

CLAIM
#1



$D_c = \text{chroma } \Delta$ } compute both
 $D_s = \text{structure } \Delta$ } each time

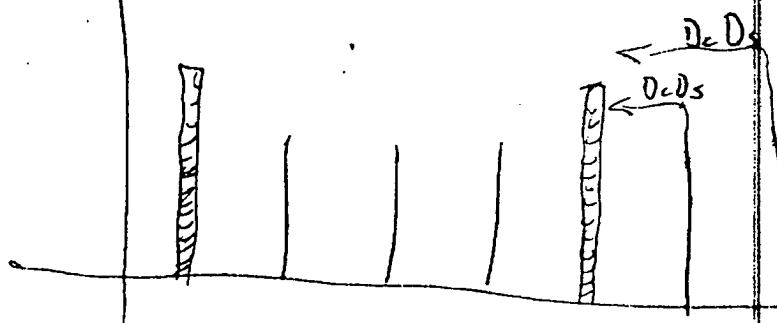
Claim #1, steps a) through d)



each difference exceeds
its corresponding threshold
step e)

↑
becomes new
KF

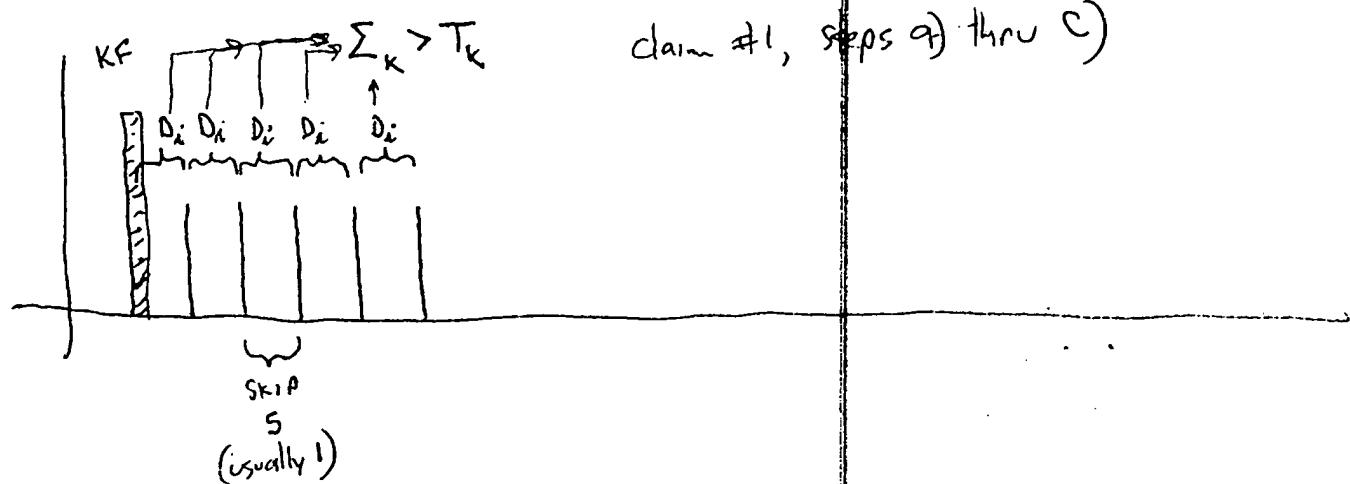
Report



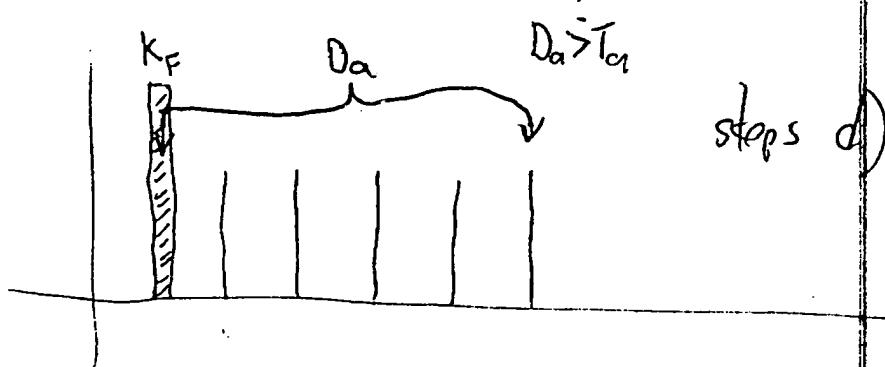
claim 2,3

ZHANG

Integrate



Then, once $\sum_k > T_k$, compute D_a :



Now, if $D_a > T_a$ (second difference exceeds second threshold)
Then declare a new KF; repeat

